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REMARKS

Support For Amendments. Claim 1 is amended to recite a sample light reception unit and a main light reception unit, where the sample unit measures a portion of the light transmitted through the article *simultaneously* with the measurement by the main light reception unit. This amendment is supported in Fig. 2 and in the specification at page 24, lines 11-24 , reading

> .... a line sensor 10 constituting a main light reception unit comprising a group of charge accumulation type photodetection elements for detecting light ... obtained by spectral separation performed by this diffraction grating 9 and converting this into an amount of charge ... and an optical fiber 11 with a photodetection window 11A arranged at one end, so that the amount of light in the vicinity of $\lambda 4$ (820 nm), which is the second-order light of $\lambda 2$ (820 nm) can be read as an amount of charge; the other end of this optical fiber 11 is led to the vicinity of the initial read pixel (0) of the line sensor 10, thereby constituting a sample-use light reception unit 11B, from which sample light is obtained.

It is clear from Fig. 2 that pixel (0), and the other pixels, receive light simultaneously. The Examiner is also invited to note page 28, line 18 to page 29, line 6:

> .... as the sample-use light reception unit, one end of the optical fiber 11 is mounted in the vicinity of the pixels (0, 1, 2, 3) while the other end thereof is mounted in the position of the wavelength where the amount of transmitted light by the article to be measured on the second order light from the diffraction grating 9 is greatest. ... and the line sensor 10 commences charge accumulation from the time-point where the optimum reading position of the fruit or vegetables reaches the optic axis.

Claim 3 is rearranged, and also includes and amendment to claim 3 that is also supported in the specification at page 18, lines 1-5, which reads,

> Also at this point, the base (G_M) of the exponent portion is the maximum gain of the variable-gain type exponential amplification circuit and the deviation of the mantissa portion is determined by the resolution (Nm) of the exponent portion, the dynamic range being ($A \times G_M$).

The claim 3 amendment is further supported at page 30, lines 11-23:

> 24 shown in Figure 3 is a digitally controlled exponential amplification circuit (also referred to as a variable-gain type exponential amplification circuit or simply gain amplifier) for obtaining a prescribed gain by converting the data from the CPUs 1 and 2 to analogue voltage by means of a D/A converter, not shown, and applying this analogue voltage to the gain control input terminal of a voltage controlled exponential amplifier; the gain of this digitally controlled exponential amplification circuit 24 is thus set by a digital instruction from the CPUs 1 and 2 in accordance with the digital signal from an A/D converter 26, to be described. The value of G_M (the maximum gain), which is the base of the gain, is also set.

No new matter has been added.

The new claims are supported in Figs. 1-2 and the specification. New claim 9 is discussed below (§112 rejection). The new claims are patentable by dependence as below.

Variation and Saturation. When measuring articles such as fruits by transmitted light, there can be wide a variation in the amplitude of the transmitted light (specification page 2, lines 8-11 and spanning pages 2-3). These variations create a problem with setting the gain in the electronics which extract the data from light-sensitive elements (page 8, line 15 *ff.*), because the electronics can become saturated with too much signal.

Also, the optical path length through an article will change during the light accumulation time, unless the article is held stationary. If preliminary and main measurements are used, then there may be a large difference between the preliminary and main measurements due to article motion. The concentration, pigment, or shape will change unless the article is fixed in position, and the measurements not be the same in corresponding portions of the preliminary and main measurements. This might be especially true when measuring internal properties, such as cavities in potatoes (page 33, line 5).

The Applicant's Features. Unlike the light sensor of Fukuma, the charge accumulation-type devices of the Applicant can be read only once, and then must recharge for some time. This behavior is related to the provision of both the sample-use light reception portion and the main light reception unit. These two units reach full charge at about the same time. Then, the sample-use light reception portion is read out, with the gain of the variable-gain amplification circuit set low. This provides a measure of what amounts of charge are to be expected to be read out from the pixels of the main light reception unit. The A/D value resulting from reading the charge of the sample-use light reception portion is compared to the predetermined reference value, and the read-out of the main light reception unit can then be optimized. The zero-point correction circuit is used to increase the signal-to-noise ratio.

According to the Applicant, the main and sample light reception units accumulate light *simultaneously,* after the light has passed through the article and been spectrally separated. This prevents any discrepancy between the two measurements, and greater precision is possible.

In contrast, the Applicant's Related Art *first* separates light into spectral components, and *then* passes it though the article being measured (see the bottom of page 1, "first of all, light from the light source is divided into monochromatic light by for example a diffraction grating and is then simultaneously directed onto the article to be measured"). The Fukuma reference is similar to the Related Art in having this the feature; this is discussed below.

The Applicant uses the sample light—which is proportional to the main light because of the common path through the article—and sets the gain of a variable-gain type amplification circuit by performing a comparison with a reference level. The gain is set so as to assure that the digital value obtained by the A/D converter has a sufficient number of significant digits for accurate calculation. When reading the charges of the main light reception unit, noise reduction

is performed in the analogue circuit by performing zero-point correction on all of the amplification systems successively prior to reading. Thus, A/D conversion can be performed at a suitable analogue level.

With the Applicant's arrangement, there is no possibility of the spectral data being either saturated or too low, and it is also possible to cope with changes in the article-feed speed (i.e., exposure time). This provides a spectrophotometer with an extremely large dynamic range, high speed, and low noise. Automatic sensitivity adjustment (automatic gain control) is possible without employing a high-resolution A/D converter, which is expensive and has a low processing speed, or an expensive logarithmic amplifier (specification page 22, lines 8-13).

Remarks. In response to the outstanding Office Action:

(1) Fig. 4 was objected for showing only prior art, and correction of the drawing is required. The objection and requirement are respectfully traversed.

The specification states (page 6, last paragraph) that "Figure 4 shows the wavelength characteristic of oranges." This wavelength characteristic is a naturally-occurring property of a naturally-occurring object, and therefore is not patentable under 35 USC §101. Because the subject matter of Figure 4 is not patentable, it cannot be prior art. Prior art is, by definition, a prior invention. Withdrawal of the objection and the requirement are requested.

(2) The Abstract was objected to and correction was required. The amended abstract contains 145 words.

(3) The claims were objected to for inconsistencies and were rejected under 35 U.S.C. §112, second paragraph, for indefiniteness. The claims are amended in view of the Examiner's remarks. Withdrawal of the objection and rejection is requested.

The rejection is respectfully traversed in part, as follows:

(i) In regard to the Examiner's question about whether there is a preamplifier for each of the main and sample-use units, the Applicant points out that in the optical-fiber embodiment of Fig. 5(a), both use the same preamplifier and sensor drive circuit; however, the embodiment of Fig. 5(b), a photodiode array, has respective preamplifiers for the main and sample-use light reception units. With respect, claim 1 need not be further limited. The language "_a_ pre-amplifier and drive circuit" covers one, or more than one. New claim 9 is believed to clarify and overcome any indefiniteness which might remain in claim 1.

It is noted that in the optical fiber embodiment of Fig. 5(a), charge from the photodetection elements or pixels is sent to the preamplifier, but not to the drive circuit.

(ii) The Examiner questions how the reference value from the main reception unit is obtained by the digital comparison means. The Applicant answers that a reference is not obtained from the main light reception unit. A fixed value is previously determined as a reference value wherein a maximum value of a spectrum waveform is around a maximum value from the A/D converter.

In more detail, on page 17 of the specification, Equation 1 is: $It = A \cdot G_M^{-(Nm)}$. Suppose that in the A/D converter A = 12BIT = 4095; the maximum gain of the variable gain type exponential amplification circuit portion G_M = 100 times; the digital resolution capacity of the gain amplification circuit Nm = 8BIT = 255; and the set value is N = 0~255. The A/D converter becomes saturated at 4096 and above. An example of a reference value below saturation might be, for example, 3800. The light transmitted through the article is accumulated for the necessary exposure time and read out of the sample-use light reception unit. The A/D conversion value is compared to the reference value 3800, and "N" of the variable-gain type exponential

amplification circuit is set so that the maximum value of the A/D conversion value of the *main* light reception unit is around 3800. Then the spectrum is read out.

(iii) In answer to the Examiner's question about the number of significant digits, the Applicant asserts for the record that the number of significant digits of a digital value has a well-known meaning. The language of claim 1, "the number of significant digits of the digital value is not reduced," means that the maximum value of the spectrum is be measured is maintained around the maximum value of the A/D converter.

(4) Claim 1 is rejected under 35 U.S.C. §103(a) as being obvious over Fukuma, US 5,106,190, in view of Baun, US 2006/0092508, and Official Notice. This rejection is respectfully traversed.

The Examiner states (page 4, 6th line from the bottom), "it is not disclosed in the claim where the spectrometer has to be in relation to the sample, therefore, it could be before the sample, as disclosed by Fukuma." However, if the spectrometer were before the sample, as the Examiner proposes, the light transmitted through the sample would be monochromatic.

Claim 1 now recites "a main light reception unit including a group of charge accumulation type photodetection-element pixels which receive, *for each wavelength or wavelength band of light* emitted from the light emission means, light that has been transmitted through the article [and] a sample-use light reception unit ... reading the charge of *a specified wavelength*." Also, as noted above, claim 1 is amended to recite that the sample unit and the main light reception unit receive light transmitted through the article simultaneously. The light could not be received simultaneously at both unless the specified wavelength is the same as the other wavelengths, that is, if there is only one wavelength. But a single wavelength is contradictory to the feature of spectral separation (dispersion).

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New claim 5 recites that the article to be measured is disposed between the light emission means and the spectrometer, which is not disclosed by Fukuma.

In Fukuma's spectroscope 2 light is "separated depending on the wavelengths" and then chopped (col. 2, line 32). Thus, only a single wavelength is going to the photodiode 15 at any one time. New claim 7 recites that the light is not chopped, and claim 8 recites plural wavelengths at the pixels.

Fukuma does not disclose such features as "the number of significant digits ... is not reduced" or "acquiring a wavelength characteristic by sequentially reading the group of charges accumulated on said main light reception unit."

Claims 2-4 are not substantively rejected, and are amended to overcome the rejection under § 112. The Applicant therefore submits that these claims should now be allowable regardless of the status of claim 1. Allowance of the application is requested.

Respectfully submitted,

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